

IV. "Contributions to Terrestrial Magnetism.—No. X." By Lieut.-General EDWARD SABINE, R.A., President of the Royal Society.
Received June 7, 1866.

(Abstract.)

In this number of the Contributions to Terrestrial Magnetism the author resumes the discussion of the results obtained in the Magnetic Survey of the Southern Ocean by the Expedition under Sir James Clark Ross, R.N., and Captain Francis Rawdon Crozier, R.N., between the years 1839 and 1843. The proceedings during the two first years of this Survey have been the subjects of two preceding numbers of the Contributions, viz. of Nos. V. and VI., in the Philosophical Transactions for 1843 and 1844. The present number contains a similarly detailed exposition of the operations of the third year of the Survey, comprehending the Southern Atlantic between Cape Horn and the Cape of Good Hope, and completing the circumnavigation of the southern hemisphere, from the departure of the expedition from the Cape of Good Hope in March 1840, to the return to the same station in April 1843. In a subsequent memoir, which will be presented to the Royal Society early in the ensuing Session, the author proposes to connect and thoroughly coordinate the three portions of the Survey, and to supply from them the numerical data at equidistant points on each of the three parallels of 50° , 60° , and 70° of south latitude, of the three magnetic elements, which will be required for a revision of the 'Allgemeine Theorie des Erdmagnetismus' of M. Gauss—the 40th parallel having been the most southern available at the epoch of the publication of the original work.

The instruments employed in this Survey, as well as the methods of employing them, and of eliminating the disturbing influence of the iron in the equipment of the vessels, having been in a great measure of a novel character, a discussion of considerable length bearing on all such points is prefixed to a full detail of the observations themselves, arranged in Tables, showing in every instance both the immediate results of the observations, and the corrections which have been applied in conformity with the principles contained in the preliminary discussion. Tabular abstracts are also furnished, exhibiting the results of the determinations of each day, with the appropriate geographical positions.

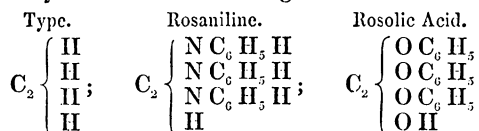
June 21, 1866.

Lieut.-General SABINE, President, in the Chair.

Dr. Hugo Müller, Mr. Perkin, the Rev. Canon Selwyn, and the Rev. R. Townsend, were admitted into the Society.

- I. "On the Relation of Rosaniline to Rosolic Acid." By H. CARO, and J. ALFRED WANKLYN, Professor of Chemistry at the London Institution. Communicated by Dr. FRANKLAND. Received June 5, 1866.

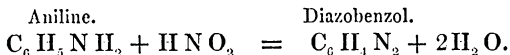
At the Meeting of the British Association held in Bath in the year 1864, it was pointed out by one of us that rosaniline and rosolic acid might be represented as ethylene which had undergone substitution:—



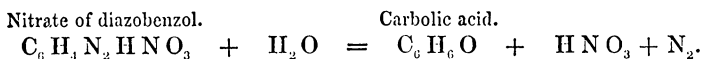
Rosaniline and rosolic acid became members of the same family, the former being an ethylene containing N $\left\{ \begin{array}{c} C_6 H_5 \\ H \end{array} \right.$ in place of hydrogen, the latter also an ethylene, but containing O C₆ H₅ and O H in place of hydrogen. Some of the reasons for assigning these formulæ were given in the communication made to the Bath Meeting.

The relationship between rosaniline and rosolic acid is very well brought out by the facts which will presently be brought forward.

Griess has shown that aniline and nitrous acid yield water and diazobenzol:—



Diazobenzol is a most remarkable compound, forming salts which are very explosive, and which undergo certain very interesting transformations under the influence of reagents. It is moreover the representative of a numerous class of compounds derived similarly by the action of nitrous acid on different bases, and for the most part resembling itself in the explosive character of the salts. One of the most remarkable reactions presented by diazobenzol is that with water, wherein the whole of the nitrogen of the diazobenzol is evolved, and its place supplied by an atom of water:—

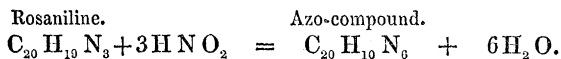


This elegant form of reaction appears to be characteristic of the class to which diazobenzol belongs; and Griess has resorted to a measurement of the quantity of nitrogen set free during the reaction, as a means of arriving at the composition of the azo-compounds.

Hofmann showed, some years ago, that rosaniline, after treatment with nitrous acid, is capable of forming a platinum compound endowed with explosive properties, but appears not to have followed the investigation further.

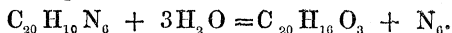
Paraf has recently shown that rosaniline salts are converted by nitrous acid into a dye, which he considered to be rosolic acid. We have also investigated the action of nitrous acid on rosaniline, and arrive at the following results:—

When an acid solution of a salt of rosaniline is mixed with nitrous acid, it forms an azo-compound, which corresponds very closely in character to diazobenzol. Like diazobenzol this compound forms explosive salts; like diazobenzol it decomposes with evolution of nitrogen gas when it is boiled with acids. In adding the nitrous acid to the solution of rosaniline to form the compound, it is easy to observe the exact point at which the solution ceases to contain unaltered rosaniline. It thus becomes easy to determine the amount of nitrous acid consumed in the conversion of a given weight of rosaniline into the azo-compound. We have done this by the employment of a method which gives excellent results when applied to aniline and toluidine, and the details of which will shortly be published by one of us. We obtain as the result of our experiments, that one molecule of rosaniline consumes three equivalents of nitrous acid; and the equation representing the reaction will be



On boiling this azo-compound with hydrochloric acid, there is evolution of nitrogen gas. The volume of nitrogen was measured. The result was that one molecule of rosaniline, after conversion into the azo-compound, yields six equivalents of nitrogen.

Azo-compound.



These changes in composition are accompanied by striking physical effects. The deep-red solution of the salt of rosaniline becomes brown on the addition of excess of hydrochloric acid, then yellow as the nitrous acid is added; then there is much froth, and as the solution is boiled it gradually becomes red yellow, and a large quantity of a deep-coloured solid with cantharides-like lustre separates out.

Seeing that this solid is produced by treating rosaniline with three equivalents of nitrous acid, and that six equivalents of nitrogen are evolved, it must be a non-nitrogenous substance. A careful comparison of its properties and reactions with those of the rosolic acid described by Kolbe and Schmitt, and now made largely as an article of commerce, leads to the conclusion that it is identical with rosolic acid.

The following characters are common to it and to the rosolic acid of Kolbe and Schmitt.

1. A yellowish-red solid with cantharides-like lustre, only sparingly soluble in water, soluble in ether and alcohol.

2. Easily soluble in ammonia, and in alkalies generally, forming red solutions of very great colouring-power. Addition of acids to these solutions decolorizes them, precipitating the colouring-matter in the form of a yellowish precipitate, which varies much in tint.

3. When boiled with aniline and a little benzoic acid, it forms a blue dye, there being no evolution of ammonia. The blue dye is very soluble

in alcohol, not soluble in water; it is the salt of a red-coloured base. It dissolves in strong sulphuric acid, giving a red solution.

4. Submitted to destructive distillation, it gives abundance of carbofic acid, leaving a carbonaceous residue.

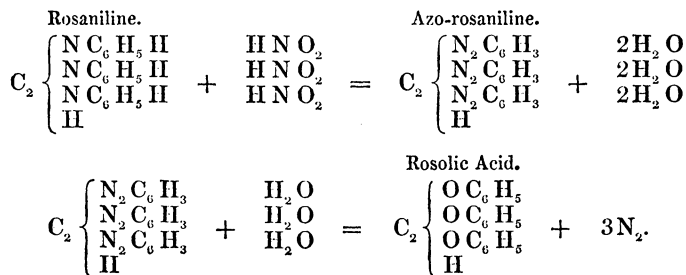
5. The deep-red solutions in alkalis are easily reduced on boiling them with zinc powder; so treated they lose their colour; but restoration of the colour takes place on adding ferricyanide of potassium.

There is only one particular in which any difference could be detected between the product obtained from rosaniline and that obtained from carbofic acid by Kolbe and Schmitt's process.

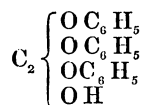
The rosolic acid of Kolbe and Schmitt forms salts the solutions of which are darkened by ferricyanide of potassium. The product obtained from rosaniline does not darken, or darkens only very slightly, on the addition of ferricyanide. An explanation of this difference is afforded by the following experimental facts. The product from rosaniline after reduction with zinc becomes capable of being darkened by ferricyanide; and if leucaniline, instead of rosaniline, be taken, there is obtained a cantharides-like product, which gives red solutions with alkalis, but is darkened by ferricyanide. Furthermore, if a solution of Kolbe and Schmitt's rosolic acid be darkened with ferricyanide of potassium, and then precipitated by the addition of an acid, there results a colour-acid, which dissolves in alkalis, giving solutions of the exact tint of the rosaniline-product, and, like it, incapable of being deepened by ferricyanide. The interpretation of all this is, that the rosolic acid obtained from carbofic acid by the action of sulphuric and oxalic acid (Kolbe and Schmitt) contains more or less leuco-rosolic acid, produced probably by the reducing action of some sulphurous acid. The rosolic acid got from leucaniline also contains more or less leuco-rosolic acid. The rosolic acid obtained from rosaniline is free, or almost free, from leuco-rosolic acid.

Be this, however, as it may, there can be no doubt that rosaniline and carbofic acid give essentially the same product when the former is treated with nitrous acid in the manner we have described, and the latter with sulphuric and oxalic acids as in Kolbe and Schmitt's process.

Adopting the "Ethylene type," we have the following expressions for the reactions of rosaniline:—



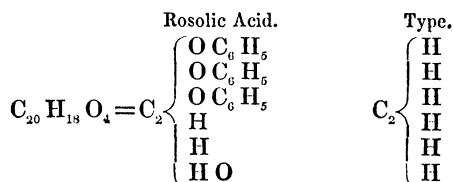
On comparing the formula of rosolic acid given thus by Griess's process applied to rosaniline, we find that it differs from the formula deduced from Kolbe and Schmitt's analysis, viz.



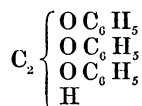
by one atom of oxygen.

We are inclined to think that this difficulty must be got over by correcting the formula deduced from Kolbe and Schmitt's research. If the numbers required by the formulæ $C_{20} H_{16} O_4$ and $C_{20} H_{18} O_4$ be calculated, it will be found that both of them fall sufficiently near the analytical results actually obtained to allow of the deduction of either from the analyses.

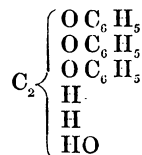
Taking the latter, viz. $C_{20} H_{18} O_4$, all will become intelligible :—



Thus rosolic acid appears as an ethyl-hydride, and its generation in the Griess process applied to rosaniline is obvious. To the formula



which is derived from rosaniline by the straightforward action of nitrous acid and water, we have to add $H_2 O$, and we get



which is, as was said, a possible expression of the analyses of the rosolic acid obtained from carbolic acid.